paleæ and the flowering culms included in their sheaths, grows sparingly along the margins of the pond and elsewhere in the vicinity in damp places. Mr. Burk has observed this second form for twelve or fifteen years past on the hard dry surface of the Point Road below the old Southwark Canal. He states it to have been more abundant in 1866 than ever before. *Hab.*—Pennsylvania and southward; Gray. Nat. from Europe.

100. Dactyloctenium Ægyptiacum, *Willd.* Ballast Ground and Kaighn's Point, 1864, 1865, 1866. Common in both localities. Rather less frequent in 1866 than before. *Hab.*—Virginia, Illinois and southward; Gray.

101. Leptochloa mucronata, *Kunth.* Kaighn's Point, 1865. Not frequent. *Hab.*—Virginia to Illinois and southward; Gray.

102. Leptochloa fascicularis, *Gray.* Kaighn's Point, 1866. Collected by Mr. Burk. Scarce. *Hab.*—Rhode Island and Southward along the coast; Gray.

103. Glyceria distans, *Wahl.* Spreading over the vacant lots west of the Ballast Ground. Abundant. *Hab.*—Salt marshes along the coast; Gray.

104. Brizopyrum spicatum, *Hook.* Ballast Ground, 1865, 1866. Staminate plants only. *Hab.*—Salt marshes; Gray.

105. Paspalum distichum, *L.* Ballast Ground, 1864, 1865, 1866. Along the wet margin of the pond, in similar places at Kaighn's Point, and in 1866 at Petty's Island. Abundant and with mature fruit. *Hab.*—Virginia and southward; Gray.

106. Panicum amarum, *Ell.* Ballast Ground, 1865. Two flowering specimens. Again in 1866, but only one or two plants not in flower. *Hab.*—Sandy shores, Connecticut and southward; Gray.

The Cutting Ant of Texas—OECODOMA TEXANA, Buckley.

BY GIDEON LINCECUM.

In many portions of Texas this species of ant is quite numerous and troublesome. It is capable of and actually does perpetrate more real perplexing injury to the horticulturist and farmer, than all the other types of Texan ants put together. In form and color the larger varieties of them do not differ in appearance very much from the agricultural ants. A great portion of our citizens speak of these two ants without distinction, as being the same species. There is, however, a well-marked difference in their community regulations; in their manners and customs, in their mode of constructing their cities, in their peculiar food and manner of preparing it, and in their civil and military governments.

There are five varieties or castes in this species, all of which may be seen in the same community, or city as I prefer to call it. They vary in size from that of a drone honey bee down to near that of the little black erratic ant; and their duties and vocations are as variant as their sizes. The largest size have wings and are the mother ants. They dwell in the ground in sandy lands, and one of their long established cities will, on an average, occupy at least two square rods of surface. The area of the city is considerably elevated; often one to two feet, and sometimes even more. The earth which is thus thrown up, and which is universally sand, is thrown out from their numerous and capacious cells below, and from their extensive tunnels or subterranean passages. To their cells they have many holes, or places of entrance, and some of them are tunnelled off several hundred yards.

It is known to many observant Texans that in all the larger cities the ants

have penetrated the earth to water. This accords with my not very limited experience on the subject. I know of a number of wells which were intentionally sunk in the cutting ant hills to procure water, and I have been informed by the owners of these wells, that ant cells, tunnels and live ants were found all the way down to the water. I have myself seen and drank water out of eight of these wells, and have accounts of many others. I have not heard of a failure in any attempt for obtaining water by digging in a cutting ant hill.

Mr. G. W. Brooks states that, in Chappel Hill, Washington County, Texas, Columbus Pearson dug a well in an ant hill and obtained plenty of water at the depth of thirty feet. The facts in this case worthy of notice, and for which it is here recorded, is the manner in which the ants had also sunk two wells to the water. These ant wells were large and well-formed, one of them being fully twelve inches in diameter, the other six inches, both going straight down to the water. The walls of these wells were travel-worn and stained of a dirty brown color, presenting the appearance of having been in use for years. Mr. Pearson states that, if these ant wells had been opened properly, a bucket could have been let down the largest one at the outset.

Dr. Fechtig, of Brenham, informed me that he had been making observations on the cutting ant for some months; and some of his discoveries, which he was kind enough to communicate to me, are valuable and of an interesting character, particularly as they afford additional testimony in favor of observations I have made in reference to the disposition of the dirt which comes out of their tunnels, &c. These passages are always commenced within the compass of the city mound; the sand that is taken from the tunnels is always thrown back on the mound. These tunnels are made at the depth of eight to twelve inches, and in the direction of the object for which they are excavated. Sometimes, as I will show presently, on extraordinary occasions they are carried at a much greater depth. Dr. Fechtig's case, which I will now relate, was a tunnel from one of their cities to a neighboring well; the tunnel entering the well ten or twelve feet below the surface of the ground. The well being walled with oak timbers, the ants had cut their way through to gain access to the water. In performing the boring through the thick oaken curbing, they threw down into the well so much saw-dust that the people were forced to strain the water previous to using it. On examination Dr. Fechtig found that a quantity of oak chips, similar to those which had been separated from the well water, had also been thrown out on the ant mound.

Situated in a garden at Austin, Texas, there was a large, very populous and seemingly prosperous cutting ant city. The ants had for years, in spite of many patent traps and newly discovered ant poisons, damaged the garden extensively. The proprietor of the garden at last conceived the idea that he would try to drown them, and for this purpose dug a large basin-formed pit in the ant mound, and led trenches into it right and left from the hillside above the ant city, to convey the water into the basin when it should rain. Not long after this preparation was completed, there came a tremendous rain storm. Large quantities of water rushed along the ditches into the basin dug in the mound. To the gentleman's surprise the basin did not fill, but seemed to send forth hollow sounds. After the rain was over it was found that all the water which had been conveyed into the basin had been swallowed up. There is a creek with a flat rock bottom about seventy yards from the ant hill, and it was discovered that the water from the trenches had rushed down the wells of the ant city, washing out, down to the rock, (22 feet), an immense hole, thence along a great tunnel on top of the rock, to the before named creek, where the entire sluice, charged with millions of ants and sand and mud, made its escape into the creek.

Under a beautiful wide spreading live-oak (Q. Virens) on the west border of the town of La Grange, Texas, there was an extensive and flourishing ant city. The city mound was large, occupying the entire area overshadowed by the

live-oak. Nearly on a level and not exceeding eighty yards from the ant hill, there was a considerable pond of filthy water, which, being in the street, the town authorities ordered it drained. A ditch was opened along one side of the street which intersected the ant mound near its center, and for the purpose of inundating and drowning the ants, the workmen let the water into the ditch, and when it reached the mound (which had been ditched through to its further side) it found many open passages, down which it flowed quite freely. It was near night when the workmen left it, with the water passing into and seeming to be rapidly enlarging the hole it had already opened in the mound.

The workmen and a number of the town people visited the place next morning. The pond was dry, and the ant mound had also disappeared; and what was more wonderful still, the large live-oak had settled down into the chasm that had been made by the disappearance of tbe ant mound, until the lower limbs of the tree were resting on the brink of it. (The lower limbs of a prairie live-oak are seldom more than six or seven feet above ground.) The outer ends of the very numerous live-oak roots were still clinging by their long ramifications in the walls of the great pit all around, and the large tree was swinging securely upon this net-work of roots as upon a hammock. But where did the water, mound and ants all go to? was the question among the La Grange folks. The Colorado river passes in its deep channel three hundred yards distant from the ant hill, and the popular supposition was, that the mound, ants and all, had passed through their great tunnel, which they had previously excavated, into the river. Several years have gone by, and still when it rains the pond vents itself through that ant chasm, and the live-oak, though still green and thrifty, has settled deeper in the ground. I know of many other wells and tunnels that were made by the cutting ants, but as I have recorded a sufficient number of them here to establish these great works as a characteristic trait in their national action, it is deemed unnecessary to add any more.

All the sand and other material that is seen piled on the ant mound comes from the wells, tunnels and cells which are excavated for the accommodation of the ants. The work required to throw up these quite conspicuous mounds must have consumed many years, as well as an immense amount of labor. All the sand-carrying labor is performed by the smaller sizes of ants, principally by the very smallest. These are of a dingy brown color, and when crowded have a woolly appearance. These little fellows are lazy and extremely slow in their motion; seeming to perform their daily work with great reluctance. They are often found crowding in each others way about the gates of the city, and do not seem to feel any interest in what they are doing, which is to carry sand day by day. For their size they carry large loads, but they lose the advantage of the big loads by their slow motions. The larger types of this species, which move with greater celerity, pay no attention to the sand carriers, but pass out and in, walking over them and their big loads of sand as if they were the pavement. While I observe the slow, careless action of these lazy little mound builders, I cannot avoid the conclusion that they are slaves.

As the cutting ants perform their destructive works mostly during the night, I have not made sufficient observation on their nocturnal action to state certainly that they employ their slaves in the leaf-cutting business at all. They have large mandibles and sharp teeth, and I think it likely that they are capable and, perhaps, do participate in the labors and duties of all the departments in the national works. The cutting ants subsist entirely on the leaves of vegetables. They will eat the leaves of various trees, shrubs and some herbaceous plants. I have not observed them eating of any of the grasses. Sometimes during warm spells in winter when, as I suppose, their provision stores have run short, I have seen them cutting and carrying home the buds of the long moss (Tillandsia usneoides.) I think, however, that this alternative is resorted to only in periods of great scarcity; as I have never observed them collecting the moss during summer, or at any other time while the season of green foliage continues. They seem to have a regular and well disciplined corps of foragers,

and these, after a suitable tree has been selected by their scouts for them to work at, go forth about twilight and, ascending the designated tree, frequently the tallest willow-oak, (Q. phellos) commence the work of destruction. They cut the green leaves into pieces not much less than a five cent piece, and seizing it near one corner with their capacious mandibles elevate it, and tilting it backwards over the crown of the head, it falls edgewise between two strong spines, or horns, which stand erect at the back part of the forehead. Having their load thus adjusted, which, to the observer, seems to stand on its edge on top of the head and lengthways with the body, they hasten away to the appointed place of deposit. It is quite an interesting sight to observe with what precision and celerity they can edge their piece of leaf along amongst hundreds of their fellow laborers who are all carrying similar burthens, while they are meeting on the path an equal number of workers who are hurrying back to the tree empty.

They deposit the leaves on the ground at the place appointed for curing them, where they are left to dry in the sun through the succeeding day. Sometimes the new cut leaves are deposited near the entrance to the city; at other times they are strewed thickly along the path from the tree to the city; and not unfrequently they are thrown down in a pile near the root of the tree from whence they were taken. In either case they are left exposed all day in the sunshine; und they are, during the succeeding night, carefully gathered up and taken into the city; this rule obtains in autumn; they do not cure their leaves until towards winter. All summer time they are carried directly from the tree into the city. Whilst the dried leaves are being stored away, the foragers are engaged in cutting and laying out a quantity of fresh leaves, which undergo the same processes of curing and storing as the previous lot; and so on through the season for storing up food for winter. But should a shower of rain fall upon and wet the laid out leaves while they are out drying, it renders them unfit for food, and they are not stored. I have noticed many piles of these spoiled leaves rotting on the ground that had been damaged by being caught in the rain.

In my observations on the habits of the cutting ants, I have not discovered them eating anything besides the foliage of various plants. Neither have I ever noticed them carrying anything else into their cities. Prof. S. B. Buckley, who is a very close and accurate observer, states that he saw them carrying hackberries (Celtis occidentalis) and that they eat insects, tumble bugs, &c. The hackberry has a sweet pulpy covering, and I think it likely that if one of the leaf-eating ants was to find a hackberry, it would try to carry it home; but it being a perfect globe, a little too large for the span of its mandibles, I see not how it could effect it. As to their feeding on insects, I shall not pretend to deny it, for these wonderful, cunning and very sagacious ants doubtless perform many habitual actions that have passed unnoticed in my eighteen years observation.

It is stated that this species of ant does not lay up stores of provisions for winter supplies. I have not opened one of their cities during winter, and therefore cannot assert that they do. But from the immense quantities of leaves collected by them during the autumnal months, which are carefully sun dried and taken into the city, I should feel at a loss to say, if it is not intended for winter food, what other use they can put such quantities of leaves to; and furthermore, when it is known to be the kind of food upon which they subsist. It is also known that they construct cells from fifteen to twenty-five feet below the surface—below the line of change of temperature,—and in these deep subterranean apartments for their winter quarters, they would not become torpid, but would remain active. Now, if during the warm season it is necessary for them to consume the almost incredible amount of leaves which we see them daily carrying in, it becomes a matter of surprise—an unaccountable thing indeed—how they can make out through the winter months without anything to eat, when we know that they are not in a torpid state but lively and active.

In this vicinity within the last two years, (1861) the cutting-ants have greatly diminished. Many large cities have dwindled away to a few thinly populated holes; whilst many others are entirely depopulated. This, I think, is mainly attributable to the protracted dry weather. With many other species, particularly the agricultural and little black ants, long drouths seems to favor their increase. Not so with the cutting ant. They evidently decline. A seven years drouth would cause their wells to dry up as it did many of the wells belonging to the *genus homo*. I know of several very pretty homes that were evacuated the present year by human families, on account of the failure of their wells. Their wells dried up, and as they could not deepen them sufficiently to obtain a supply of water, they were obliged to leave their long cherished and well-fixed homes. The ants have done the same thing, and as I think for the same reason. Their wells also failed and they have perished for want of water, or have emigrated to districts more congenial to their peculiar mode of life. Anyhow, they have greatly diminished, and many large cities are actually depopulated and lying in ruins.

On the first of August, 1861, I discovered in a grove of thick timber and much undergrowth, a great many cutting-ant holes. They were all around in the bushes, extending perhaps over an acre of ground. They were all alike of recent date; their newly thrown up little heaps of fresh sand was what first attracted my attention. Finding them there on the hill-side, and actually boring holes in the thick woods, was a performance so entirely contrary to their customary habits, that I was led to the examination of the matter, and if possible to ascertain the cause of this strange unantlike proceeding. My first impression was, there being a large and very ancient city a few hundred yards distant from the new settlement, that it was the work of the recently thrown off queens from that old kingdom; that the young queens had stopped short in the shady woods in consequence of the hot dry weather, and were setting up for themselves in a new style, it being on a declivity and in a densely shaded woodland. I however excused them for all these flagrant deviations from their long established customs, by laying it to the continuous drouth and hot weather. I did not leave them until I had marked the place that I might visit them again, and find out how such a multiplicity of new settlements in so small a track of country would manage in the future. I then paid a visit to the large old ant city spoken of above. I had many times within the preceding twelve years, visited and made observations on its extraordinary public works. When I came there I was astonished to find that its inhabitants were all gone. I found only the large old mound of sand, now smoothed down by time's sweeping winds and the passing cattle, but there were no inhabitants—all had disappeared. They had evidently emigrated to the new settlements I had encountered down the hillside in the thick shady forest, and the inhabitants thereof were not, as I at first surmised, the newly commenced communities of the young queens, but emigrating parties who had gone out from the old city in search of water. Their wells having failed, they could no longer remain in the city, and having left it, had proceeded lower down the hill, and hoping to find water, were sinking many new wells. Subsequent observations have confirmed me in this opinion. The new settlements in a short time were evacuated. Having been unsuccessful in obtaining water at the new place, the ants had either died out or gone to some other district.

In accordance with my observations on this subject, I am forced to the conclusion that the drouth continued too long for them; that in districts where the wells are liable to dry up they often perish. I find that the kingdoms that are located near a constant stream, are in a flourishing state, and have continued so through all the time of the protracted dry season.

The cutting-ants plant seeds of various trees, vines and other plants. When they locate a city in bald prairie, which is often the case, where they cannot procure the seeds of trees, they cultivate the prickly poppy (Argemone Mexicana,) the most appropriate plant for their purpose that grows on the prairie.

The seeds of this poppy are planted over the greater portion of the crown of the city mound; the plant springs up during the autumnal rains, forms strong roots in the course of the winter, and by the time the sun becomes oppressively hot the next spring, it has grown up two or three feet high, with umbrageous green foliage and many large white flowers, and affords ample shade to the city.

When the ants locate a city on some sunny point near the timbered lands, they do not plant the poppy, but appear to prefer certain trees and vines for shade. For this purpose they plant the seeds of the prairie dogwood, (Viburnum dentatum), Yopon, (Ilex vomitoria), Hackberry tree, (Celtis occidentalis), Gum elastic tree, (Bumelia lycioides), the mustang grape, (Vitis Texana), Cocculus carolinus, and occasionally the prickly ash (Xanthoxylum fraxinium.)

It is often seen in cases of long established cities, that grape vines spread themselves over the tops of the grown up shade trees, and the large luxuriant foliage becomes so dense that it forms a shelter sufficient to turn a smart shower of rain. From the scorching rays of the sun these thrifty vines afford thorough protection.

Notwithstanding the notable fact that all the plants these ants cultivate, produce nuts, pulpy fruits and large seeds, I have not discovered that they make use of any of them for food. They appear to be a selection for shade, and so far I have not observed that they have any other use. If, however, after a more careful investigation it shall be discovered that they cultivate the vines, trees and fruitful shrubs for the double purpose of both shade and food, we must accord to them a share of sagacity and far-reaching forethought almost incredible.

I have occasionally discovered colonies of small sized red ants, which in form resemble the smallest type of the cutting ants. They dwell in the ground. I have not seen them cutting or carrying leaves. I have observed them thickly covering a greasy rag, places where syrup had been spilt, and where coffee grounds had been thrown aside at my hunting camps. They are not often met with, and as I now think, never will be, so long as the superior and very numerous race of cutting-ants inhabit the land.

The smallest type found in the cities of the cutting-ants, which I have before alluded to as being slaves, are in shape, size, color, and all their peculiar motions, precisely the same. How happens it that the same species of ant should occupy two very distinctly marked conditions? In one he dwells in small colonies, makes very little mark, is never wealthy, and does not remain long at the same station. In the other he is a slave!

How the cutting-ant manages to make slaves of the smaller race is as yet an unsolved question. The cutting-ant does, to be sure, perform all his thieving operations at night, or by the aid of an underground passage, if in the day time. Consequently our observations on the mode of carrying on the slave-trade must necessarily be tedious and limited. But the cutting-ants have what I take to be slaves in great numbers; and the same type that constitutes their slave population, is found sometimes free, but very poor and in straggling communities.

The fact that these little sand-carrying ants are a servile race, I think cannot well be denied. If they are produced from the eggs of the cutting-ant by a peculiar process of feeding, as is the case in producing the various types found in a community, or hive of honey bees, then the conclusion will follow, that there are no proper communities of the smaller type, and the little nests that I have occasionally seen of them, were nothing more than companies of badly managing absconded slaves.

26*th February*, 1861. There was a heavy rain last night. To-day it is very clear and pleasant; thermometer 70°. Everything that has life in it or can grow is in motion. I was out on the prairie botanizing, and while resting in the shade of a large live-oak which was nearly in full bloom, I discovered great numbers of all sizes of the cutting-ants ascending and descending the tree. On the ground beneath the tree were thousands of the ants carrying

pieces of the leaves of various plants. The greater portion were carrying the leaves of the live-oak. Some of the leaves were faded and nearly dry, and all were the growth of the previous year. Seeing no ant hill near I undertook to find out how far they carried their leaves through the thick grass. In a short time I discovered that they carried them above ground but a small distance to a little pile of leaves and trash, under which they went dragging their cut leaves with them. Turning up the little pile of leafy trash, which seemed to have been driven there by the winds, in a depression of the ground that was probably an old horse track, there was a hole a full inch in diameter. Not a particle of dirt had been thrown out around it, and yet the hole was large and slanted away to the northwest. There were thousands of the ants at work in the shade of the live-oak, gathering up the leaves that were being constantly cut down from above, and on closer scrutiny I found several other holes into which they were going with leaves. These holes also slanted off under the surface, but had no earth thrown out around them, and were all alike concealed with leaves and little sticks. All the holes were crowded with the ants going in with leaves, or coming out empty. With such a number of ants and so many holes one would expect to find heaps of earth piled out around them, but such was not the case. The holes were the outer termini of the subterranean passages they had run out from their city, about fifty yards distant, and piled on their city mound lay the sand that came from the passages. These passages, or tunnels, are constructed for the purpose of avoiding the almost insurmountable difficulty they would have to encounter in the effort to carry their leaves through the tangled grass; and also apparently to make it possible for them to obtain food in times of scarcity during the cold weather. The cutting-ants are very easily stiffened with the cold air, and cannot succeed in scrambling through fifty yards of thick grass with a leaf of a cold day. But with the underground roads, in almost any kind of weather, they can go to the terminus, hastily run out and snatching up a recently fallen live-oak leaf, take it home through the tunnel without difficulty.

I saw the ants carrying nothing but leaves during this day's observation, neither have I ever observed this species collect any other kind of food except small flowers and the petals of larger ones; but these are no more than tender leaves.

At the ant city there appeared to be a great turn out of the ants this fine day. I noticed four sizes of them. Most of the slaves were engaged packing out sand upon the city mound. There were, however, a considerable sprinkling of them in company with the larger sizes packing leaves. I noticed also a great number of their giants, walking to and fro with the laborers, but they performed no work that I saw. The giants are large, and have a large head with strong mandibles. They are well-formed for the execution of much of their kind of labor; but I did not discover that they did any work, though they were passing up and down the tree and along the road with the laborers all the time. All the small ones—the slaves—and the second sized ones—which may also be slaves—were unremitting in their labors. The third size, or class, also carried leaves quite busily.

This species of ant often carry their subterranean roads to the distance of several hundred yards from the city in grassy districts, but where the grass has been destroyed, they do not construct the underground passages, but travel over land in nicely cleared out roads, which are seen radiating from the city mound and extending to various trees, or spots of herbage which produce suitable leaves for their subsistence. To see one of these well-cleared roads extending in a continuous line from the city to some tree or garden two or three hundred yards distant is indeed remarkable. This fact, in a district nude of grass, occurs so often that it cannot be attributed to chance, or blind instinct. Some of the engineers in their excursions in search of supplies, often wander to the distance of four or five hundred yards, or even further, and finding a plentiful source of good food, would find no difficulty in con-

ducting parties the best route to it; and soon a good smooth road is constructed, over which in crowds the workers are seen through the night, or in cool cloudy days, transporting the leaves to the city. This is their mode, invariably, in a country where the grass has been destroyed, and we can see and understand the method and the purpose for which they work. But in a country which is heavily coated with high grass, it is not so easy to discover by what process they lay off a tunnel and successfully carry it in a direct line to the selected tree or garden spot a quarter of a mile distant, and sometimes beyond a considerable streamlet of running water.

On one occasion, on a log that lay across the Ye Gua Creek, the ants passed over to a gentleman's garden and were rapidly cutting his vegetables to pieces. The owner hoping to rid the garden of these troublesome insects, cut the log away and it floated off down the creek. He was mistaken in his calculations, for it was but a few days after when the ants were ravaging the garden in as great numbers as they were previous to the removal of the log. After searching unsuccessfully for some interlocking tree that might afford them a passage, it was observed that the ants came out from several holes, situated on the creek side of the garden. Subsequently it was discovered that, on a large ant mound crowning a sandy point near the edge of some post-oak timber, two hundred yards from the creek, there were quantities of the black soil of the Ye Gua bottom thrown out, proving that the second visit of the ants to the gentleman's garden had been effected by a tunnel beneath the bed of the creek; the channel of the creek, at that place is fifteen or twenty feet deep, and from bank to bank on top of the bluff about thirty feet.

By what degree of the *instinctive* powers was all this engineering and truly great project accomplished.

I have never seen the cutting ants fighting among themselves, or with any of the other species. I look upon them as the most peaceable, the most sagacious, and at the same time the most destructive of the ant kind.

March 5th.

The President, DR. HAYS, in the Chair.

Thirty-six members present.

The following papers were presented for publication:

"On the Structure of Lopezia." By Thomas Meehan.

"Mammalogical Notices." By J. H. Slack, M. D.

March 12th.

MR. CASSIN, Vice-President, in the Chair.

Forty-two members present.

The death was announced of Prince Maximilian, of Wied, a Correspondent.

The following was presented for publication:

"The necessity of Nebular Rotation." By J. Ennis.

Prof. Cope exhibited the fossil skull of a large turtle, from a soft granular limestone belonging to the cretaceous formation of Barnsboro, Gloucester Co., N. J. It was characterized under the name of Euclastes platyops. The length of the skull is 11 inches; its breadth 8½ inches.